Emerging Nonirrigation Demands for Water

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THE TRANSFER OF WATER from irrigation to nonirrigation uses is an emerging problem of great economic interest. As population grows in the West, water for new and different uses is a limiting resource in many areas. Even where water exists in abundance for established uses, a shift to new uses is often a problem. Any transfer of water rights that influences existing rights on a watercourse frequently becomes involved in litigation. The outcome may prove unsatisfactory to the purchaser of the rights. Inflexibilities in the transfer of water rights force water supply organizations, such as water conservancy districts serving large areas and many users, to play an increasingly important role in transfers to new rural-domestic, municipal, and other nonirrigation uses. Central to the performance of this function is the ability of water users to trade water contracts within the area served by the water supply organization. With water rights held by large water supply organizations, the service contract becomes the key to establishing a new use and to making capital investments to utilize transferred water.

A leading example is the Northern Colorado Water Conservancy District (NCWCD), one of the major water supply agencies of the Western region. This was not organized to be a source of domestic and industrial water, yet it is beginning to feel the demands for changing uses of its water supply. The Colorado-Big Thompson project (C-BT) in Northeastern Colorado was developed to collect, store, and divert surplus water from the upper Colorado River to supply supplemental water to 615,000 acres of NCWCD lands in the South Platte River Basin. Early studies estimated an overall area need for supplemental water of about half an acre-foot per acre. During the first 10 years of full operation the system nearly met this need. But increasing quantities now are being purchased by various organizations for domestic, municipal, and other nonirrigation uses.

During the District's formative period, farmers' applications for C-BT allotments of supplemental water were based upon their estimates of need for additional irrigation water. When an allotment was granted, a tax lien of $1.50 per acre-foot unit per year was attached to the land where the water was to be used. The term "unit" is used because the C-BT project does not deliver a full acre-foot of water in most years. A total of 310,000 units were granted to water users in the District, but during the first 10 years of operation, annual water deliveries averaged 228,845 acre-feet of water or about 74 percent of a full acre-foot.

The need for additional irrigation water varies widely because the present water supplies of companies vary, depending upon their water rights (dates and quantities), and the capacity of reservoirs in relation to amount of land served by the company. In addition, some water allotments from C-BT were granted before the system was completed. Consequently, no one knew for certain what the actual deliveries to individual farms would be. Some farmers would probably have more supplemental water than they needed; others would have less. Hence, provisions were made for seasonal rental and for permanent transfer of NCWCD water allotments.[1]

Approval of the Conservancy District Directors is required for the transfer of a water allotment from one use or location to another and to change the tax lien from the transferor's property to the transferee's. In the last 6 years, more than 11,500 acre-foot units have been transferred to rural-domestic, industrial, and municipal ownership. Actual delivery of water to nonirrigation uses rose from 5,695 acre-feet in 1960 to 26,550 acre-feet in 1964.

Substantial transfers of water to nonagricultural uses were not anticipated when the

[1] See R. L. Anderson, "The Water Rental Market: A Case Study," Agr. Econ. Res. XIII: 54-58 (April 1961).

original allotments were granted. Initially, the municipalities within the Conservancy District reserved about 45,000 acre-foot units for eventual municipal use. Some cities are now purchasing additional allotments to increase their holdings of Conservancy District water. During 1964, for instance, the city of Fort Collins purchased 1,355 acre-foot units and the city of Boulder purchased 1,000 acre-foot units.

Rural-Domestic Systems Develop

One of the largest nonirrigation demands is being created by recently organized rural-domestic water systems that have developed along the front range of the Rocky Mountains in Boulder, Weld, and Larimer Counties, north of the Denver metropolitan area. The purchase of water by domestic water systems has been the primary reason for the rise in transfer price of NCWCD allotments from $30 in 1960 to $100 in 1964.

Ten organizations, nine using C-BT water, have been formed to supply domestic water to farms and rural homes in an area of approximately 1,500 square miles in the three counties. Five rural-domestic water systems are organized as associations financed by the Farmers Home Administration. Others are organized as special districts financed by bond issues.

Rural water systems obtain their water from two major foothill reservoirs operated by the NCWCD. A common technique is to filter the water at the reservoirs, then pipe it along county roads to the water users. As most systems do not provide service beyond the boundaries of existing county roads, customers must provide waterlines from the road to their homesites. Pipes used by the water systems are mainly the new and relatively inexpensive asbestos cement and plastic types.

Water Pricing by Northern Colorado Water Conservancy District

Under the original water service contract, the Conservancy District's annual water charge to agricultural users cannot be more than $1.50 per acre-foot unit of C-BT water. This provision sets a limit on the amount of water revenue available to the Conservancy District. To overcome this restriction on water revenue, the Conservancy District revised its rules to provide that any water allotments reallocated or transferred no longer carry a fixed assessment of $1.50, but are subject to annual rate review by the Board of Directors of the District.[2] Current water charges by the NCWCD are $1.50 per acre-foot unit for irrigation and municipally owned water under original contract, and $3 for water owned by rural-domestic water systems and others under an open-rate contract. Recently the District has instituted a sliding scale for water allotments purchased by municipalities during the last 5 years. This scale will raise the rate to $5 per unit in 1965 and to $15 by 1969. For the time being, the District does not plan to raise the annual rate for water allotments transferred to irrigators or to rural-domestic systems.

Water Rates of Municipal and Rural-Domestic Water Systems

Water charges set by the developing rural-domestic water organizations are much higher than municipal rates in the area (table 1). Municipal rates average 43 cents per 1,000 gallons for 10,000 delivered gallons per month, while rural-domestic charges run from $1.35 to $1.55 per 1,000 gallons at this level of delivery. One city has recently installed water-meters in its service area, making its water rate higher than that in the cities still using a flat rate for most service.

The new domestic water supply organizations initially serve only a few customers per mile of line and are financed by relatively short-term loans and bond issues, except for FHA financing which may be 40 years. To cover fixed charges on the borrowed funds and still have revenue for operation and maintenance, water rates are necessarily high. Most of the organizations are attempting to repay construction costs from water revenue, although those

[2] NCWCD Rules and Regulations for Reallocation and Transfer of Water Allotments, March 1961, p. 9.

Table 1.--Monthly water rates per 1,000 gallons for selected municipality and rural-domestic water supply systems, Colorado, 1965

Thousand gallons per month	Ft. Collins - Loveland and East Larimer Water District	Little Thompson Water District	Left Hand and Foothills Water Ass'n.	Three municipalities[1]	North Weld County Water District
	Dollars	*Dollars*	*Dollars*	*Dollars*	*Dollars*
4.....	--	--	--	.93	2.06
5.....	1.77	2.40	2.00	.65	--
7.....	--	--	--	.60	1.79
10.....	1.46	1.50	1.35	.43	1.55
15.....	1.07	1.17	1.07	.39	1.18
20.....	.88	.98	.92	.36	1.00
40.....	.59	.66	.61	.31	.61
60.....	.49	.54	.51	.29	.48
80.....	.44	.48	.46	.27	.46
100.....	.42	.44	.42	.26	.45

[1] This is the mean rate for water delivered by meter in Ft. Collins, Greeley, and Boulder. Most water in Ft. Collins and Greeley is sold on a flat fee basis determined by size of house, number of bathrooms, and size of lot. A typical single-family dwelling pays between $40 and $80 per year for water service, depending on size of house and lot area.

organized as special districts have the power to levy an ad valorem tax. Most do not intend to use the taxing powers unless water revenue should be inadequate. The basic water rates were apparently set near costs for water delivered by tank-truck to farmers' cisterns. Many rural homeowners and farmers formerly used trucked water because of the poor quality of well water in the area.

Table 2 shows the retail value of water delivered for domestic and municipal use on an acre-foot basis. While the data are not strictly comparable, rural-domestic water organizations are shown to charge anywhere

Table 2.--Retail value of water per acre-foot in selected municipality and rural-domestic water systems, Colorado, 1965

Thousand gallons per month	Ft. Collins - Loveland and East Larimer Water District	Little Thompson Water District	Left Hand and Foothills Water Assoc.	Three municipalities[1]	North Weld County Water District
	Dollars	*Dollars*	*Dollars*	*Dollars*	*Dollars*
5.....	576.75	780.00	651.70	211.80	--
10.....	474.03	487.50	439.83	140.11	505.00
20.....	285.89	317.85	301.36	117.30	325.80
40.....	191.69	208.00	199.43	101.01	199.43
60.....	160.45	175.50	165.61	94.50	157.47
80.....	144.69	154.66	148.55	87.98	150.59
100.....	135.03	143.00	138.12	84.72	146.25

[1] This is the mean value for water delivered by meter in Ft. Collins, Greeley, and Boulder. Most water in Ft. Collins and Greeley is sold on a flat fee basis determined by size of house, number of bathrooms, and size of lot.

from $780 per acre-foot delivered at 5,000 gallons per month down to $135 per acre-foot delivered at 100,000 gallons per month. Municipal charges for metered water average from $211 to $84 per acre-foot for these amounts. Declining block rates are employed by all domestic water systems in the area. Promotional rates encourage greater use of water but locally are considered desirable from the standpoint of increasing monthly revenue, especially for new systems while they are in the process of repaying construction costs.

In 1958, Renshaw estimated domestic water as having a mean value of $100 and a maximum value of $235 per acre-foot in a study reported in the Journal of American Water Works Association.[3] These estimates appear low when viewed against prices being charged water users under the new systems. Renshaw's estimates do reflect the price of domestic water under established systems as illustrated by the municipal rates shown in table 2. Domestic water users in Colorado apparently do not feel that the water charges made by the new rural-domestic systems are burdensome, because new subdivisions and rural homes are developing rapidly within the areas served by the rural-domestic systems.

Whether the prices charged by the new systems are near the upper limit that domestic users are willing to pay is not known. In the opinion of some farmers, it is not economically feasible to water livestock from sources with such high water rates. The rapid growth of these systems would seem to indicate that demand for domestic water service is relatively inelastic over a wide range of prices.

Hirshleifer, Dehaven, and Milliman state that municipal (primarily domestic) water systems typically overbuild and underprice water supply.[4] Lines as small as 4 inches and even 2 inches are common on the fringes of many rural-domestic systems. The rates set for water service by new rural-domestic systems illustrated in table 2 would substantiate the assertion by Hirshleifer, et al., that domestic water service is somewhat underpriced in many municipalities.

The rural-domestic systems may soon find that the water service they provide is inadequate for the new development taking place in their service areas, and that they will have to enlarge the capacity of the distribution systems. Some trunklines have sufficient capacity to serve more water users but many areas have small lines with little excess capacity to serve future customers. One of the serious problems faced by the new rural-domestic water systems concerns the best strategy for developing waterlines to service present and prospective customers. Because most systems are financed by bond issues backed by a lien on taxable property within the district, efforts are made to include as much property as possible to get a large tax base.

The above points emphasize that water supplies for newly emerging uses are difficult and expensive to acquire in Colorado and probably elsewhere in the West, a chief reason being that, under the appropriation doctrine, most of the available water has been appropriated by irrigation uses, and the holders of irrigation rights are reluctant to allow transfer to emerging uses. When rural-domestic water systems develop, municipalities grow, or new industries come into an area, they compete with irrigation for water supplies and bid up the value of water.

In the case of developing uses within the NCWCD area in Colorado, organizations needing water buy allotments of supplemental irrigation water produced by the C-BT project to supply their needs, not because water is scarce from other sources, but because institutional barriers prevent easy transfer of local water rights.

The rate for raw water delivered by the NCWCD is $1.50 per acre-foot for irrigation use, and $3 per acre-foot for water delivered to rural-domestic water organizations. The price charged for water sold by rural-domestic water organizations ranges from $135 to $780 per acre-foot; for municipalities from $84 to $211 per acre-foot. In view of the high values placed on water by nonirrigation users and the

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[3] Edward Renshaw, "Value of an Acre Foot of Water," Jour. Amer. Water Works Assoc. 50:304 (March 1958).

[4] J. Hirshleifer, J. Dehaven, and J. Milliman, "Water Supply," Univ. Chicago Press, 1960, pp. 107-109.

need for expanded water revenues, the NCWCD is raising its water rates to nonagricultural users.

Inflexibility in water transfer under the existing water laws of Colorado has intensified the demand by emerging uses within the Conservancy District for C-BT water. The availability of C-BT water stimulates nonirrigation uses which could not effectively acquire water rights from local sources and probably accelerates economic development within the Conservancy District.

Implications for Transfers of Water to Nonagricultural Uses

Transfer of water to domestic, municipal, and other nonagricultural uses in northern Colorado as reviewed here has several important implications. For example, because most water rights cannot be converted easily from one use to another in Colorado, a heavy burden of emerging uses within the NCWCD will fall on C-BT water. The value of an acre-foot of C-BT water for domestic, municipal, and industrial uses is many times greater than its value for agricultural uses. Superior economic power on the part of domestic and municipal users enables them to bid water away from irrigation users and makes transfers between agricultural users difficult.

Readily transferable water is extremely valuable in an area where all available water has been appropriated. Nonagricultural demands for water are increasing as large areas of farmland are being opened to subdivision development. More than 100 rural subdivisions have been recorded since 1960. Industries also are locating within the NCWCD area, creating a further direct demand for C-BT water. Economic growth will probably take place more readily where transferable water is available.

Rural-domestic systems, municipalities, and industries try to obtain C-BT water because of the certainty of supply, good quality, and ease of acquisition. Other means of obtaining water exist, such as purchasing irrigation or reservoir company stock and small irrigation ditches, or drilling wells. However, these methods do not promise water of known quality and quantity or usability over a large geographic area. Because of physical and institutional barriers, the NCWCD is the logical source for emerging uses of water. Acquisition of water from any other source, such as irrigation rights, local reservoirs, or wells, would involve uncertainties of ownership and quantity or quality that most new owners would not want to risk.

Physical supply of transferable water will not be a limiting factor in the growth of nonirrigation uses, as the C-BT system annually delivers between 225,000 and 300,000 acre-feet of water. The price of C-BT allotments to be transferred will be bid up as nonirrigation users continue to buy water allotments from farmers in the area.

Where there is no new supply of water such as that delivered by the C-BT project, emerging uses will have to compete with established uses. This process usually will require substantial adjustments in existing water allocations and will prove costly to the developing uses. The ability to pay high prices for water will enable domestic, municipal, and industrial users to shift adequate water from irrigation uses or to develop "new" water. If the water is diverted from the older uses, rules and laws governing water allocation will have to be modified to accommodate the emerging needs. Sometimes this is accomplished in the process of changing land uses from agriculture to urban uses. At other times outright purchase of water will be necessary with the consequent adjustments in established uses. Increasing competition should lead to more economical use of water on the part of both irrigation and nonirrigation users.

Concluding Comments

Development of rural domestic water systems to serve areas beyond municipal water systems is a phenomenon that can be expected to accelerate in many irrigated areas of the West. The Farmers Home Administration program for financing water systems serving low-density areas with insured loans will be a helpful factor in developing rural water systems.

Even if more financing should prove necessary, as it has in some instances, the promise of insured loans will be enough to start plans to develop rural-domestic water systems. Once domestic water systems are developed in irrigated areas of the West, real estate promoters from urban areas of the region will look at irrigated lands as potential subdivision sites. California has experienced suburban expansion in irrigated areas for some time. Agricultural areas in Utah, Idaho, Nevada, Arizona, and other Western States that are growing rapidly in urban population, are particularly vulnerable to suburban development.